

Coastal and marine resource management in the Galapagos Islands and the Archipelago of San Andres: Issues, problems and opportunities

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Abstract

Tourism and fisheries comprise the economic backbone of the Galapagos Islands, Ecuador and the Archipelago of San Andres, Colombia. The health of fishery resources, the environment and their dependant industries is discussed against a background of policy development and user conflicts, supported by a range of technical studies undertaken between 1998 and 2002, setting the scene for an examination of a more participatory and effective role for local stakeholders in the management of their island resources. Local stakeholders have been involved in guiding plans on future management of both islands' resources including Biosphere Reserve designation of the San Andres Archipelago and the development of a Special Law for Galapagos. Their participation is deemed essential to progress in marine resource management and zoning initiatives within the islands.

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1. Introduction

With the aim of improving established marine resource management techniques in the developing world, a collaborative programme of research based on joint problem analysis and advanced assessment tools commenced in 1998 with pilot studies in the Caribbean Archipelago of San Andres (Colombia) and the Eastern Pacific Galapagos Islands (Ecuador). These two island ecosystems, although geographically distinct, have a number of common issues relating to their economic reliance on tourism and fisheries and their need for good (cooperative) conservation management if long-term sustainability is to be achieved.

The emphasis of the programme was on a participatory process involving all stakeholders, and was based on sound technical data and the training of personnel in advanced analytical techniques at the two European collaborating institutions (Heriot-Watt University, Scotland and the Institute of Marine Biology of Crete, Greece). From the commencement of the programme, research input to both islands was weighted according to their priorities and established processes. Galapagos lacked the good technical information on fisheries and tourism required to aid management decision-making, and its participatory process was newly established and still finding its feet through confidence building. Conversely in San Andres little consultation occurred between tourism, fisheries and conservation sectors and a participatory management framework required development. Specific test cases were considered the best way to identify and address problems and conflicts, and formed the key focus of the research programme. The spiny lobster was identified as a focus because it comprised a key resource affected by tourism and fisheries in both archipelagos, with exploitation generating conflict between these industries and conservation. In Galapagos, lobsters were illegally caught from some tourist boats and were consumed by tourists, who were often ignorant of local laws, while a lucrative semi-industrial export fishery also existed. In San Andres, concern for the spiny lobster fishery was expressed because of poor inshore water quality, resulting from expansion of coastal developments, and possible overfishing, although no specific studies had been undertaken. To this end, the technical remit of the research involved the training of personnel, based in Galapagos and San Andres, in lobster stock assessment tools and environmental impact assessment techniques. These techniques were then utilised in both island groups to develop a clearer idea of the problems and issues facing the fishing, tourism and conservation sectors.

Parallel to technical studies was a research programme investigating participatory management and conflict resolution. The conflict assessment tool Assessment of Group Options with Reasonable Accord (AGORA) was utilised in both island groups. This is addressed in greater detail in Davos et al. (this special issue). AGORA is an evaluation and decision-making support system, which can lead to preference rankings of a set of alternative policies (e.g. projects, laws, regulations and plans). It can also be used for facilitating the value debate, particularly the discourse on priorities assigned to various criteria for choosing among future actions, such as economic development, environmental protection, intergenerational equity and public health. Through the establishment of evaluation criteria and the determination of individual stakeholder priorities with respect to these criteria, it is possible to identify potential areas for stakeholder coalition and solidarity and thus provide the basis for exploring potential future negotiation and examining the source and reasons for disagreements.

In this paper the status of fishery resources, the environment and their dependant industries, in the San Andres and Galapagos archipelagos, are discussed against a background of policy development and user conflicts. The various technical studies, undertaken between 1998 and 2002, set the scene for an examination of a more participatory and effective role for local stakeholders in the management of their island resources. A prominent feature of the research undertaken in San Andres and the Galapagos is its multidisciplinary nature.

2. The San Andres Archipelago

2.1. Location

The Archipelago of San Andres, Old Providence and Santa Catalina is located in the Western Caribbean. Part of the West Indies, these islands are Colombia's only oceanic and English-speaking department. Declared the Seaflower Biosphere Reserve in November 2000 by the Man and the Biosphere (MAB) Programme of the United Nations Educational, Scientific, and Cultural Organisation (UNESCO), this archipelago is one of the most isolated island regions in the Americas. It is made up of three small inhabited islands—San Andres, Old Providence and Santa Catalina (OPSC), and several uninhabited cays. The terrestrial area is 57 km², while the marine area is approximately 300,000 km² covering about 10% of the Caribbean Sea. Maritime borders are shared with Jamaica, the Cayman Islands, Honduras, Nicaragua, Costa Rica and Panama. The largest island, San Andres, is 800 km north west of Colombia's north coast, 200 km east of Nicaragua, and 725 km south of Grand Cayman at 12°32'N and 81°43'W. The islands of OPSC, which are separated by a 150 m channel and connected by a footbridge, are located in the middle of the archipelago 80 km north of San Andres at 13°20'N and 81°22'W. Cays and banks north of the inhabited islands include Roncador, Serrana, Quitasueño (Queen), Serranilla, New Shoal and Alicia Shoal. Albuquerque (SSW Cay) and Courtown (ESE Cay) lie south of San Andres.

2.2. General ecology

The region includes highly intact ecosystems representative of tropical marine and coastal environments, including mangrove swamps, seagrass beds, tropical dry forest, deep-water areas and coral reefs. The marine area includes one of the most extensive and productive reef systems in the western hemisphere, comprising two barrier reefs surrounding the islands of San Andres and OPSC, five atolls, and other coral banks extending more than 500 km along the Nicaraguan rise. The OPSC barrier reef alone is 32 km long and covers an area of 255 km², making it one of the largest true barrier reefs in the Americas [1]. The archipelago's reef formations are particularly complex because of the open oceanic location and adaptation to heavy wave action. The barrier reefs windward of the inhabited islands enclose lagoons rich in seagrass beds, as do the atolls in the north and south. Around San Andres and OPSC, the coastal mangrove swamps complete highly intact and productive coral reef ecosystems.

The region is defined as a secondary Endemic Bird Area and a centre of high or very high marine endemism. Additionally, the western Caribbean has been identified as a major site of coral and fish diversity and is considered a biodiversity "hot spot" [2].

The archipelago provides feeding and nesting areas for sea turtles (hawksbill, green, leatherback, and loggerhead). Several species of coral, fish, and avifauna are listed on the World Conservation Union (IUCN) Red List along with marine turtles [3]. Important commercial species include queen conch (*Strombus gigas*), spiny lobster and spotted spiny lobster (*Panulirus argus*, *P. guttatus*), and food fish such as snappers, groupers, and other associated reef species.

2.3. Socio-economic background

The islands' inhabitants fall into three main subgroups: the native West Indian islanders of Anglo-Puritan/African heritage, resident immigrants from continental Colombia and their descendants, and resident immigrants from foreign countries, mainly from the Middle East, Central America and Europe. Native islanders have the legal protection granted to national ethnic minorities—defined as groups with a culture distinct from that of the dominant society—by Colombia's 1991 Constitution. English is the mother tongue of the native population. The new Constitution grants the archipelago two official languages: English and Spanish. Spanish-speaking continentals have been the majority in San Andres since the 1980s, while native islanders remain the majority in OPSC.

San Andres, with an area of 27 km², has an official population of 61,000 and an estimated population of over 80,000. These figures do not include the “floating” population of tourists, vacation-home owners and seasonal workers. With a permanent population density of at least 2259 inhabitants per km², San Andres is the most densely populated oceanic island in the Americas, and possibly in the world. In 1985, according to the National Census, the population of San Andres was a little under 36,000. Eight years later, the official census recorded a population of over 61,000. Over half-live in the urban centre, which has developed with minimal planning on coastal flats and unstable filled wetlands at the north end of the island. In 2001 there were 44 shantytowns. Population information for these areas is not accurate. These settlements, which house primarily recent immigrants from Colombia's Caribbean coast, are unplanned and without legal public services.

The free port designation given to San Andres in 1953 shifted the economic base from small-scale agriculture and fishing, beginning a process of economic and political marginalisation of native islanders. The uncontrolled influx of immigrants seeking work in the rapidly expanding tourism and commercial sectors, coupled with economic incentives that encouraged continental Colombians to settle in San Andres, led to impoverished social conditions, inequitable benefit distribution, divisive cultural tensions, and a decline in quality of life. This situation has been exacerbated in the past decade by the economic and political crises affecting Colombia and by the collapse of the free port tourism model, which resulted from loosening national trade restrictions. Unemployment is 53.6%, with an estimated 48.6% of the population having less than the World Bank's poverty criterion of US \$1 per person per day [4]. Economic activities are tourism, commerce, government employment, artisanal fishing, and traditional agriculture. There is also a very active informal economy.

In contrast, the islands of OPSC are among the least environmentally and culturally degraded in the Caribbean. These tiny islands have an area of 18 km² with a population of 4200. The traditional economic base of fruit farming, cattle and small animal raising, and fishing declined in the 1970s because of drought, agricultural disease, and increased

importation of cheap foodstuffs. These factors, when combined with national policies that hindered growth of private enterprise, have resulted in a dependence on municipal employment. The main economic activities are government employment, tourism, artisanal fishing, home-based industries, and agriculture. Unemployment is as high or higher than in San Andres.

The archipelago's gross domestic product was estimated at \$196,274 million Colombian pesos in 1995 by the National Department of Statistics. The great majority of this revenue, \$187,442 million, is tourism-related. The tourist industry employs 44.51% of the work force (tourist services 27.43% and related businesses 17.08%), while 37.48% are employed by the public sector [5]. Severe cuts in the number of government jobs in the year 2000 worsened the already poor economic situation. Income is low: 32% of the working age population have no income and for the population who have an income, nearly half earn less than the minimum wage, i.e., less than Col \$240,000 (US \$100) per month. Tourism, water sports, and fishing directly rely on coastal and marine resources.

2.4. Administrative and political background

Although Colombia has governed the islands for a century and a half, national presence was minimal until the 1960s. Prior to the free port declaration in 1953, the islands had been ignored for about 300 years. Having minimal outside political or economic interference, the islanders essentially governed themselves. Historically the islands were also distinguished from many Caribbean islands in that there was not a plantation society or colonial ruling class. During this period, the strongest influence and quasi-government authority came from the local Protestant churches, particularly Baptist and Seventh Day Adventist sects. Still today, with the addition of the Catholic Church in recent decades, these institutions are at the centre of the native islanders' social structure and religious leaders remain the primary opinion-makers. Along with the islands' small size and geographic isolation, these circumstances contributed to the creation of a society characterised as recently as 1960 by a high level of self-sufficiency and independence, an egalitarian social structure (relative to other European and New World colonial societies), little technological development, a productive and sustainable economy based on artisanal fishing and agriculture, a high quality of life (with a standard of living higher than that of the mainland and other islands in the western Caribbean), a system of measuring wealth in terms of "real" goods such as an abundance of land, crops and animals rather than in monetary terms, and functional conservation practices—particularly in the management of scarce soil and freshwater resources and in the small amount of garbage and pollution [6].

However, national and local development policies following the establishment of the free port have led to environmental degradation and a loss of ethnic identity. The environment and culture of OPSC remain more intact, but the possibility of large-scale tourism development poses a recurring threat. The archipelago's native islanders are now plagued by many of the same situations that are contributing to the destruction of cultures around the World—overpopulation, urbanisation, political and economic marginalisation, increased pressure on already depleted natural resources and ecosystems, poorly planned development, mass tourism, and the resulting loss of ethnic responses, self-reliance and cultural identity [6]. A recent trend by the churches to take an active stand on issues related to native rights, equity, land and sea tenure, local autonomy, and environmental

protection is unifying and mobilising native islanders in a fashion akin to the early stages of the church-led civil rights movement in the southern US.

3. The Galapagos Islands

3.1. Location

The Galapagos Islands straddle the Equator in the Pacific Ocean about 1000 km west of the South American coast. They comprise 13 large islands, 6 smaller ones and 107 islets and rocks, with a total land area of about 8000 km². The islands are volcanic in origin, and several volcanoes to the west of the archipelago are still very active. Geological evidence suggests that the island-forming process has followed that of the Hot Spot Theory, which states that a hot spot causes the crust to melt in certain places, giving rise to volcanoes. Galapagos volcanoes have mild eruptions by world standards. The oldest islands are towards the east and the youngest towards the west, a consequence of west to east movement of the tectonic Nazca plate. The islands range in age from less than a million years to a maximum of 5 million years. The highest volcano, Wolf, on Isabela Island, rises 1707 m above sea level. Fernandina Island is the youngest and registers the most volcanic activity. The last eruption occurred in 1998.

The Galapagos Archipelago is situated at the convergence of three major seasonally varying current systems: the Peru Current—the northern extension of the Humboldt Current, which deflects cool-subantarctic water up the western coast of South America; the Cromwell Current—a cool-water, high-nutrient current which flows eastward along the equator below 100 m depth but is deflected upwards to the sea surface on striking the Galapagos Plateau; and the Panama Current—a warm-water, low-nutrient extension of the North Equatorial Counter Current, which seasonally arrives in Galapagos from the north-east and possesses particular force during El Nino years. Amongst the consequences of this physical setting are that marine species dispersing from a variety of different regions reach the archipelago intermittently, that a huge range of temperature and nutrient regimes coexist over an extremely small geographic area, and that the total number of species is high.

3.2. General ecology

Galapagos is home to many unique animals, most of which are fearless due to a lack of natural predators. One of the best known, the giant tortoise, has evolved into 14 distinct forms on the different islands (three of them extinct). Other reptiles include the marine iguana, which grazes on seaweed, land iguanas, lava lizards and snakes. The only native terrestrial mammals are rice rats and two species of bat. The 13 species of small, brownish finches are adapted to a range of different foods and are known collectively as Darwin's finches. They have been important to scientists trying to understand evolutionary processes, and include the tool-using woodpecker and mangrove finches. Other endemic (only found in Galapagos) land birds include a hawk, dove, flycatcher, rail and 4 species of mocking bird. There are also at least 1600 species of insects, 80 spiders, 300 beetles, 150 mites, 80 land snails, and many other smaller animals.

The plants of Galapagos are equally fascinating. In the highlands are many species of endemic *Scalesia* ('tree daisies') as well as tree ferns, bromeliads and orchids. Around the

coasts are giant prickly pear and candelabra cacti while tiny *Brachycereus* cacti grow on barren lava flows. Vivid morning glories and mats of bright red *sesuvium* can be found on the shores. Galapagos also has endemic species of cotton, tomato, pepper, guava and passion flower. Many kinds of plants, particularly those belonging to the daisy family, have evolved on the different islands into arrays of endemic species, providing scientists with classic examples of what is known as adaptive radiation.

With respect to the marine realm, the great diversity of ecosystem types allows quite different assemblages of plants and animals to occur on islands separated by only 50 km. Overall, Galapagos is home to a unique combination of tropical species (such as corals, boobies, hammerhead sharks and manta rays), temperate species (such as kelps and sea lions), and species more typical of sub-antarctic seas (such as albatrosses and penguins). Clearly, no other location exists worldwide where penguins co-exist with reef-building corals. Because of its isolation, Galapagos also acts as a refuge for numerous endemic plants and animals, including anomalous species like the marine iguanas. The proportion of species endemic to Galapagos varies considerably between different taxonomic groups, but averages about 20% overall, an exceptionally high figure for a region of its size [7].

3.3. Socio-economic background

Galapagos had no aboriginal inhabitants and was only officially discovered in 1535 by Tomas de Berlanga, the Bishop of Panama, when his ship was becalmed and carried there by currents. During the 17th and 18th centuries, buccaneers used the islands as a staging post, stocking up on water and giant tortoises, which they stowed alive aboard their ships for fresh meat before carrying out raids on the South American coast. During the 19th century whalers and fur sealers further exploited the islands. Ecuador annexed Galapagos in 1832 and small colonies were gradually established on several of the islands.

Up to 1950, the Galapagos Archipelago was scarcely inhabited. In 1950, 1346 people were registered, whereas the population in 2000 exceeded 16,000. Over the last three decades, population growth has been steady and very rapid [8].

Residents in Galapagos are confined to 3% of the total land area. Eighty-six percent of the population lives in urban areas in three main districts: Puerto Baquerizo Moreno on San Cristobal Island, Puerto Ayora on Santa Cruz Island, and Puerto Villamil on Isabela Island. The remaining 14% of the population live in rural areas around these settlements and on Floreana Island. A small community, mainly composed of military personnel, lives on Baltra Island to assist in running the airport and tourist arrivals.

The emergence of economic opportunities on the islands has been a powerful draw for immigrants from mainland Ecuador. Consequently, there has been a steady increase in population over the later part of the 20th century. Until the 1960s most of the fish exported from the islands was dried and salted product (still an important export). During the late 1960s and 1970s mainland fishers started to exploit the lobster populations. The advent of cheap and quick air transport opened access to important markets in the US and allowed island-based fishers to exploit the resource. This fishery expanded rapidly over the 1980s and 1990s. The recent development of a sea cucumber fishery has provided an additional incentive for migrants.

In addition to the development of local fisheries, tourism has increased rapidly during the 1980s and 1990s with a threefold increase in the number of tourists (mostly wealthy Europeans and Americans) between 1985 and 1999. The increase in tourist numbers is

partly a response to increasing incomes in North America and Europe and also a change in the tourism market away from conventional sun/sand tourism towards activity-based holidays (cultural, nature, sport/leisure, etc.). Migrations from the mainland and the absence of any indigenous aboriginal people have resulted in a population almost entirely comprised of Hispanic Ecuadorians. Since the Special Law for Galapagos was approved in 1998, an immigration control system has been established in Galapagos, which is under the responsibility of the Galapagos National Institute (INGALA).

Ecuador is one of the poorest countries in South America. In 1994, 30.4% of the population was living below the poverty line (less than US\$1 per day in 1984 prices). For 1996, the GNP was US\$1500 per capita, compared with US\$2140 for Colombia and US\$8380 for Argentina. No official estimates of the local GDP in the Galapagos are available.

Quality-of-life indicators provide a good illustration of the relative prosperity of the Galapagos when compared to mainland Ecuador. In 1998, for example, mortality (deaths per 1000) was 1.2 for Galapagos compared with 15 for the whole of Ecuador. The illiteracy rate in Galapagos in 1998 was established as 1% and 2% among males and females, respectively, over the age of 10 [9]. This is compared with rates of 8% and 12% among males and females, respectively, over the age of 16 in 1995. The relative prosperity and quality of life in the islands is an important attraction for potential migrants from the mainland.

The data gathered by the INEC 1998 census reveal that the largest single employment sector is transport, accounting for over 25% of the male working population. This included employees on the cruise vessels. In 2000, there were 80 cruise vessels registered in the Galapagos with a total capacity of 1735 passengers. This, combined with employment in hotels and restaurants, identifies tourism as the largest employer in the islands.

4. Coastal and marine management

4.1. *San Andres*

4.1.1. *Institutional framework*

Several national and local institutions share jurisdiction and authority in the coastal and marine area in the San Andres Archipelago. These include CORALINA, the Ministry of the Environment, the Maritime and Port Authority (DIMAR), the National Fishing and Aquaculture Institute (INPA), and the Departmental Fishing Board.

CORALINA is the government agency or CAR (regional autonomous corporation) mandated to manage and regulate natural resources in the archipelago. This agency has extensive authority to manage natural resources and direct the regional planning process for land and marine use. The law 99 from the Colombian Congress set up special management regimes in specific regions, including the San Andres Archipelago, because of the significance and fragility of the ecosystems in these areas. CORALINA is one of seven CARs classified as sustainable development corporations, which have more extensive mandates than do the other regional autonomous corporations, combining conservation, planning, education, and management. CORALINA is the only CAR with jurisdiction in the marine area. Amongst CORALINA's functions is the involvement of the native community in sustainable resource management.

CORALINA submitted the application for biosphere reserve status to UNESCO's MAB programme. As a result, the San Andres Archipelago Seaflower Reserve joined the World Network of Biosphere Reserves on 10 November 2000.

Law 99/1993 gives the Ministry of the Environment all environmental powers that are not directly assigned to another authority. It also established the National Park System, in which various categories of reserves are defined, granting the Ministry the power to identify and set aside areas that will qualify as national parks. The Special Administrative Unit for the National Natural Park System manages them and reports directly to the Minister of the Environment. McBean Lagoon National Park in Old Providence, which is the only national park in the archipelago, is therefore under the jurisdiction of the Ministry of the Environment.

DIMAR has substantial authority in the area of management and enforcement of laws relating to shipping, shipboard pollution and land use for ports. DIMAR regulates dredging, construction of ports and docks, and foreign ship traffic. DIMAR also enforces laws and regulations on the nation's seas and coasts, including those regarding protection of the marine environment, fisheries, and the use of beaches and coastlines. As part of the National Armada (navy), DIMAR includes the port captains and coast guard as well as the Colombian Oceanographic Institute.

Law 13/1990 and Decree 2256/1991 established INPA as the agency to regulate fisheries in Colombian waters—including commercial and artisanal, national and foreign. A later regulation, Law 47 of 1993, decentralised this authority by creating a Departmental Board of Fishing and Aquaculture to assume these functions from INPA in the San Andres Archipelago. This Board, set up in 2000, is made up of the Governor of the Archipelago Department, the Secretary of Fisheries, the General Director of CORALINA, a representative of the artisanal fishers, and a delegate of INPA. The establishment of this board could profoundly affect fisheries management by ensuring that actions related to fisheries licensing are carried out locally. However, INPA and/or the Ministry of Agriculture have retained the power to authorise agreements with national and foreign companies, establish regulations, and set quotas. In the past, local stakeholders have found quotas to be inequitable. Therefore, the INPA delegation of functions to the Board is regarded as unsatisfactory by artisanal fishers, native rights groups, and others who favour local autonomy in fisheries management.

4.1.2. Legal and policy framework

The Colombian Constitution stipulates recognition of the principles of international law approved by the nation. The Constitution also advocates decentralised environmental management. Policies include the involvement of local communities in environmental decision-making and special provisions that further strengthen the territorial rights of the archipelago's native islanders. Given the strong participatory framework for stakeholder input in the formulation of new rules and regulations, the needs of the local community often form the basis for new initiatives such as the Biosphere Reserve.

National laws derive from the Constitution and the various international agreements. A number of national laws provide the framework for coastal and marine management in the archipelago. Of particular significance are Law 47 of 1993 that calls for the protection of coastal and marine resources and the establishment of artisanal fishing areas in the archipelago, Law 136 of 1994 that protects the archipelago's mangroves, and Ministry of

Environment Resolution 1426 of 1996 that defines the archipelago's corals as special environmental management zones. Resolution 1021 of 1995 established the only national park in the archipelago, Old Providence McBean Lagoon, which includes coastal and marine ecosystems.

The Colombian National Policy for Biodiversity (1996) focuses on conservation, knowledge and sustainable use. Strategies include sustainable renewable resource management plans, assessments of economic potential to ensure equitable use, implementation of protected areas, legislative and institutional strengthening, technology transfer, creation of biodiversity information systems, and community training and participation. National Action Plans call for coastal and marine-use planning within the framework of integrated coastal management (ICM) at regional and local levels. Local policies set forth in *The Environmental Plan for Sustainable Development of the Archipelago: 1998–2010* (approved 1998) include protective management strategies for the cays and banks, definition of significant marine areas to protect biodiversity, special measures to protect endangered species, and realignment and demarcation of coastal and marine reserve areas to protect essential habitat.

4.1.3. Participatory management

There has been little history of determining public values prior to implementing legislation. The decision-making process has generally been based on top-down management. The decentralised national environmental framework along with civic dialogue and increasing local, national, and international pressure has brought the issue of environmental values to the public. It is now common to hear environmental issues discussed at community meetings, in churches, on the radio, and in the villages. The damage to the environment and loss of environmental quality resulting from San Andres' overpopulation is a major topic of discussion. People talk of the problems with solid and liquid waste disposal, the loss of flora and fauna, and the degradation of their coastal and marine resource base. The availability and pollution of fresh water is also an important issue [10].

Awareness of the services provided by the environment is rapidly increasing. The traditional life of the islands has revolved around use of these services. The economy depends heavily upon healthy seas and the economic sustenance from them. Tourism in the islands relies on environmental amenities such as white sand beaches, clear sea water, coral reefs, and the associated flora and fauna.

While the value of a healthy environment is more widely understood and discussed today, sectoral and individual interests can be in conflict with conservation. Protection of traditional islander activities has a higher priority in the daily value discourse. There is a high level of awareness given to ecosystem protection, but prohibitions against traditional resource uses like sand extraction and catching turtles and iguanas remain highly controversial in the native community. On the other hand, many in the immigrant community, which controls the local commercial and tourism sectors, push for increased urban development and expanded mass tourism. Degradation of the marine environment and lack of local economic benefits from nationally controlled industrial fishing are matters of concern to all the islands' communities, but national interests override local calls for conservation. Similarly, while the high population numbers in San Andres are considered by most residents to be the main environmental and social problem facing that island, national policy views this as an economic problem rather than an environmental and social one.

To make local environmental decision-making more equitable and representative, CORALINA consults extensively with stakeholders. CORALINA also has a policy of hiring and training local people whenever possible, ensuring that the agency is staffed and managed by the community. International and national experts in their respective fields are also consulted as appropriate. Their advice is shared with stakeholders and can be adapted to the archipelago's specific situation and needs. When feasible technically and financially, scientific studies are carried out and existing data are reviewed in both natural and social sciences. Information generated helps determine the appropriate course of action.

State-of-the-art theory and alternatives are also considered when evaluating the direction of new regulations or projects. However, since it has been shown worldwide that environmental measures imposed from the top down are often ineffective, in the archipelago international, national, and local policy and legal frameworks are combined with stakeholder concerns to form the base on which decisions are made. Effectiveness and compliance are increased by promoting stewardship, awareness, and active participation in management. This approach does not preclude expert consultation, scientific study, and use of the more conventional tools of environmental decision-making but gives a civic collective and co-operative focus to the management process [10]. The evolution of the participatory management process in the San Andres Archipelago is discussed further in Mow et al. (this special issue).

4.2. Galapagos

4.2.1. Institutional framework

The Ministry of Environment (ME) was created in Ecuador in 1996 and is responsible for defining environmental policies and co-ordinating their implementation. It establishes basic guidelines for sustainable conservation and development in the islands. The Galapagos National Park Service (GNPS) is the ME's executive branch in the islands and is in charge of managing protected areas. Due to its size and task scope, the GNPS has established a long-term association with the Charles Darwin Foundation (CDF), which provide technical and scientific advice for conservation and controlling introduced species. CDF's technical responsibilities, set forth in a legally binding agreement entered into in 1958 and renewed in 1991 for a 25-year period, were newly brought into force and confirmed in the *The Special Law for the Conservation and Sustainable Use of the Province of Galapagos* (LEG). The LEG and the Constitution of Ecuador create a specific legal system for this province, which is presided by a local institution, the INGALA. This institution is responsible for regional planning and for the co-ordination and provision of technical advice to local institutions. Other public institutions are also responsible for supporting ecosystem conservation, for instance, the three municipalities and province divisions of the Ministries of Agriculture and Stock Farming, Health, and Education [11].

4.2.2. Legal and policy framework

The Galapagos National Park was established in 1959, registered in the World Heritage List in 1978 and designated as a Biosphere Reserve in 1984. Complementarily, the Galapagos Marine Resources Reserve (GMRR) was declared in 1986 to include the water column and sub-tidal seabed to 15-nautical miles offshore. This was subsequently extended to 40 miles in 1998 as the Galapagos Marine Reserve (GMR).

In the 1990s, the GMRR was the scene of increasing tension for access to and use of its resources. The main conflict was over the exploitation of fishing resources, which resulted in confrontations between users of the reserve.

The first Galapagos Marine Reserve Management Plan (PMRMG) was approved in 1992. Nevertheless, the reserve had legal problems over several years because its status was not legally defined in Ecuadorian legislation. Thus, it was neither a protected area nor incorporated in the National Heritage of Ecuador's natural protected areas. This issue was overcome in 1996 by declaring the GMRR as a biological reserve.

In 1996, a participatory process was started which allowed the establishment of a series of basic agreements. These provided a framework for working out *The Special Law for the Conservation and Sustainable Use of the Province of Galapagos* and for reviewing the Marine Reserve Management Plan.

The Special Law for the Conservation and Sustainable Use of the Province of Galapagos was declared in March 1998. This law, inter alia, restricted migration to the Galapagos province, allowed for locally based institutions to design and implement local management policies, provided mechanisms for local residents and institutions to capture more of the rent generated from the lucrative tourism industry, established the GMR, restricted fishing activities within the archipelago to local residents using artisanal techniques, empowered an *Authority for Inter-Institutional Management* (IMA) to establish a management plan for the GMR and vested enforcement of regulations governing the GMR with one agency—the GNPS.

Finally, the new PMRMG was approved and published in 1999. The plan resulted from a comprehensive participatory and negotiating process among key groups linked to the reserve. It permitted artisanal fishing, marine-based tourism, scientific investigation, education, navigation, and military manoeuvres within the GMR. It defined uses and prohibited activities such as industrial fishing within the marine reserve, and detailed the methods of regulation of permitted and prohibited activities in different zones. It also placed in law a need to obtain baseline information on biodiversity, population numbers of species of fishery, scientific and tourist interest, and socio-economic indicators, to allow the effectiveness of provisional marine reserve zones to be assessed at 2 and 4 years time after declaration. At the end of the 4-year period, the provisional zones are to be changed where needed and made permanent. Additionally, the management plan formally established the existence of the Participatory Management Board (PMB) as the executive forum for advice and consultation on issues relating to the GMR. The PMB is composed of representatives plus advisors from the fishing, tourist, naturalist guide, science and education (CDF), and management (GNPS) stakeholder groups, and meets approximately once per month.

Galapagos was declared an inaugural World Heritage Site in 1978, with the Ecuadorian government subsequently requesting UNESCO to recognise the Galapagos Marine Reserve as a Natural Resource of Mankind. In 1994, documentation required for this proposal was submitted. The reserve then comprised a Resources Reserve. UNESCO dismissed this proposal from the Ecuadorian government for lack of legal support for the reserve: it lacked self-management and migration restrictions. The lack of a quarantine system also influenced that decision. UNESCO urged Ecuador to commit itself to solving those problems and the government agreed. Subsequently, with the passing of the Galapagos Special Law, Ecuador demonstrated to the world its strong position to protect the islands. The marine reserve was created with this law, and *participatory management*

was recognised as a reserve management model. The GMR was declared a Natural Heritage of Mankind in December 2001.

4.2.3. *Participatory management*

The PMB is the participatory forum for users of the marine reserve and is responsible for, among other things, analysing and making recommendations on issues relevant to the reserve that are passed to IMA for ratification or decision. Such issues include zoning, integration of land and marine management plans, proposed regulations, identification of research needs and determination of their outcomes. The PMB is important for achieving the management plan objectives because it is the forum where tourism, artisanal fishing, research, and control sectors interact at the local level, generally with a consensual outcome. The PMB's meetings are a means to defuse conflicts and direct efforts towards solutions, as well as to openly discuss management steps that may affect a particular sector. For instance, fishing seasons and catch quotas are subjects dealt with and generally agreed at the PMB. This is therefore the meeting point that will make it possible to decide the enforcement of both general and specific regulations [11]. The PMB is discussed further in Heylings et al. (this special issue).

5. Fisheries

5.1. *San Andres*

The lobster fishery in San Andres and Old Providence is divided between industrial and artisanal sectors. In the region, the existing quota (as of 2002) is allocated with 200 t of lobster tail to the industrial sector and 3 t to the artisanal sector. It is widely believed that both groups exceed the quota.

The industrial fishery operates a trap and dive fishery throughout the Archipelago. Vessels are typically owned by interests based in mainland Colombia or are of foreign-registry (mainly Honduran) affiliated with mainland Colombian companies and are primarily crewed by mainland Colombians and Hondurans. The industrial fishery competes directly with artisanal fishers based in the islands. Industrial vessels land catch to processing plants on the Colombian mainland and to processors in San Andres. Catch is cleaned, graded, frozen and packaged ready for export to the US. No reliable catch estimates exist for the industrial fishery. Official estimates for landings in San Andres indicated that in 1999 approximately 165 t of lobster were landed. This catch has a trade value in the region of US\$5 m [12]. In excess of 600 people are estimated to work on board industrial vessels throughout the archipelago. Virtually no islanders are employed in this fishery. Consequently little direct economic benefit accrues to the islands. The processing sector in San Andres employs in the region of 25–30 people.

Artisanal fishers target finfish, lobster and conch. The artisanal lobster fishery is exclusively a dive fishery, exploiting resources around the main islands and nearby cays. Divers use spears guns and hooked sticks to catch lobster. Catch is stored on ice while fishing. The ability to carry ice and large amounts of fuel restricts the duration of fishing trips. Onshore, lobster is either sold directly to hotels and restaurants or more generally sold to dealers who freeze the lobster tail product before it is transported to San Andres or the mainland. Most of the lobster catch is ultimately exported to the US. The artisanal sector in San Andres is predominately a fin fishery, with incidental catches of lobster. In

OPSC lobster is an important component of total catch. There are, however, no accurate estimates of artisanal lobster catch in either San Andres or OPSC. The total catch in OPSC is probably measured in the low tens of tonnes annually. The value of this catch is likely to be in the region of US\$0.5 to 1.0 million.

A total of 215 fishers is believed to operate in OPSC, 105 of whom regularly fish for lobster [13]. An average of 4.3 people depend on the income generated by each fisher [13]. This would suggest that approximately 12% of the population is directly dependant on the lobster fishery for at least part of their income. In San Andres, 191 fishers are estimated to operate [13] suggesting approximately 1000 people are at least partly dependant on the sector (1.8% of the island's population). The artisanal fishery is dominated by native islanders (*raizales*). Fishing is seen as an important traditional activity. Consequently, the cultural and economic importance of the artisanal fishery is greater amongst this segment of the population than it is to the island as a whole.

Management issues of particular concern to artisanal fishers are the difficulty of access to historic fishing grounds, lack of local benefit from industrial fisheries, over-fishing including exploitation of threatened and endangered species, pressure on coastal and marine resources from over-population in San Andres, conflicts with naval authorities, and the failure to enforce existing fisheries regulations that include gear restrictions and closed seasons. Artisanal fishers in San Andres also say that increasingly complicated permitting procedures limit their access to the northern cays, causing them to over-exploit the more easily accessible southern region [14].

The strongest conflict centres on legal and illegal industrial fishing in the northern region. Historically, industrial fishing licences have been issued on the mainland to companies that have no local base, employ no islanders, and land little product in the archipelago. Annual quotas and fisheries management policies have also been established off-island without local participation or a solid scientific basis. Local stakeholders say these quotas are inequitable. Associated issues are a failure to respect or acknowledge traditional fishing rights and sea tenure, a desire for local autonomy in management, lack of benefit to the local community, severe over-fishing, and failure of enforcement. Related consequences are a decline in local income generated from fishing, food shortages of fish, and rising seafood prices. During consultations with the diving industry, dive operators also mention their belief that over-fishing by off-island vessels is reducing the marine biodiversity that attracts sport divers [14].

To facilitate stakeholder consultations on fisheries management, committees of artisanal fishers, known as the Artisanal Fishers Working Groups, were set up on both islands as part of the present project. The objective of these groups was to promote sustainable fisheries through the development of management strategies and protection of the rights of traditional artisanal fishers. Methods to achieve this objective within the wider goals of the project include:

- Learn about relevant norms of fisheries and marine resource management at the local, regional, national, and international levels.
- Review all legislation relevant to fisheries management within the archipelago, including those pertaining to the Departmental Fishing and Aquaculture Board (Law 47/93).
- Define priorities and values of fisheries and marine resource use.
- Examine conflicts in fisheries and marine resource use and seek ways to resolve them.
- Evaluate, define, and recommend regional management strategies; such as but not

necessarily: size limits, catch limits, closed seasons, carnets, licences and permits, approved fishing arts and methods.

- Participate in the creation of marine protected areas (MPAs) and assist in defining the zoning limits, management plans, and regulations for these areas. Goals of these areas will include recovery of local fisheries by means of habitat protection and legally defined artisanal fishing zones.

These groups have met a minimum of monthly, and generally more frequently, from the time of inception in 1999. They have also met with national and local authorities, visiting international fisheries experts, and national legal experts.

Artisanal Fishers Working Groups have requested meetings with authorities and government officials including the Governor of the Department, Secretary of Agriculture and Fisheries, Port Captains, Coast Guard Commanders, and representatives of the Ministry of the Environment. The first meeting with authorities and artisanal fishers in the conflict resolution process was held in October 2000. Since then CORALINA has arranged and facilitated meetings with all the authorities, both local and national representatives. In January 2001 an on-going series of meetings with the Port Captain and Coast Guard began. The authorities are making changes to simplify the procedure for artisanal fishers to obtain the required fishing documents, although they have not yet agreed to eliminate any of the requirements. Nine meetings were held in 2001 to further this process. Certain conflicts were resolved, but new ones constantly emerge so this process is slow, but ongoing. Nonetheless, issues related to fisheries management are being openly discussed for the first time.

5.2. Galapagos

The lobster fishery in Galapagos initially developed in the 1960s using boats from the mainland. By the mid-1980s a local fishery had emerged. Improved transportation allowed the export of the product to markets in the US. Today the fishery is conducted by surface demand diving mostly at night using spears to extract lobster from crevices. A total of 323 vessels were involved in the lobster fishery in 2002 [15]. The largest boats (known as *botes*) undertake multi-day trips freezing the catch onboard. Smaller *pangas* and *fibras* make shorter trips storing their catch on ice. The catch is purchased by dealers, and tails are frozen and stored before batch export. The use of *fibras*, which are faster with a greater range, is increasing.

The number of registered fishers in Galapagos has shown a consistent increase over time. The total number of fishers on the National Park registry in 2000 was 682, whereas the total number of fishers registered in the four island co-operatives was 1014 (Actas de la JMP, February 2000). In 2000, a total of 1229 fishers were recorded as active. Fishing operations clearly involve a large number of participants who are not registered fishers. In 2001, the GNPS through the Fishing Registry (FR) recorded a total of 833 fishers.

In 1999, the total lobster catch recorded was 54.4 Mt, increasing to 85.3 Mt in 2000. Based on a sample of 60,000 lobsters examined on board boats returning to port in 2000, 76.3% of the total catch was red lobster (*Panulirus penicillatus*), 22.9% of the catch was green lobster (*P. gracilis*), and 0.9% of the total catch was slipper lobster (*Scyllarides astori*) [16].

Significant quantities of fish are consumed within the islands. Local consumption of all sea-food may be as high as 12.7 Mt a week. Up to 50% of sea-food consumption is estimated to be by tour boats [13]. Questionnaire survey results suggest that up to 3 Mt of lobster may be consumed by tourists annually [13]. The total value of exported fish products from the Galapagos is in the region of US\$4.5 million. About US\$1 million value of lobster tail is exported primarily to markets in the US. The export value of finfish is in the region of US\$0.5 million while sea cucumber contributes in the region of US\$3.1 million to the islands' economy [13].

Different management strategies have been developed to assure the sustainability of the lobster fishery within the GMR—total allowable quota (TAQ) controls, gear restrictions, closed areas and closed seasons have been established. Closed seasons have increased over time, with the annual fishing season lasting 7 months in 1997 but being reduced to only 4 months from 1999.

The total tonnage of lobster tails under TAQ has varied amongst years. Calculations of quota for the spiny lobster fishery have been largely based on previous records of capture, whether these trended up or down, and changes in the size-frequency distribution of the catch. The quota system has been relatively easy to manage and control by means of compulsory export permits and the different monitoring certificates issued to both dealers and fishers themselves. These documents have proved indispensable as they have allowed the exact amount of lobster tails landed in Galapagos ports and later exported to mainland Ecuador to be determined. The problem with this management strategy has been the lack of enforcement once the quota has been reached. In almost every year since the fisheries monitoring programme started in 1997, the TAQ has been exceeded.

In the 2000 lobster-fishing season, the set quota was reached on 31 October 2000. This was much earlier than anticipated by fishers because of a huge increase in the fishing effort in comparison with the 1999 season (73% increase in active fishers and 107% in fishing vessels). Riots and strikes in all three inhabited islands resulted in the Minister of Environment extending the fishing quota by an additional 30–80 t in total.

The total number of fishers and fishing vessels has shown a rapid increase particularly since the opening of the sea cucumber fishery in 1999. As this fishery does not require skilled fishers, a substantial migration from other sectors as well as from mainland Ecuador was observed in the 2000 fishing season.

In 2001, before agreeing on the fishing calendar and further regulations for the lobster fishing season for that year, it was agreed at a PMB meeting that the number of fishers must be reduced to numbers similar to those before the opening of the sea cucumber fishery, thus calling for a proper identification of fishers. The GNPS, as the local management authority responsible for the GMR, began a FR, which was officially closed in late 2001. The FR provided the authorised list of fishers and fishing vessels with permits to operate within the GMR.

On 13 April 2000, the zoning scheme for the coastal region of the GMR was approved by consensus in the PMB. This zoning established extractive and non-extractive use zones: fishing 77% (sustainable extractive), tourism (non-extractive) 10%, science and conservation 8% (non-extractive), and a multiple-use zone adjacent to the inhabited ports with 5%. This zoning scheme allows specific areas to be preserved and provides insurance against over-exploitation. As the lobster fishery occurs throughout the archipelago, animals within 18% of the total coastal perimeter of Galapagos are now legally protected. Nevertheless, one problem with the zoning scheme is the lack of knowledge within the artisanal fishing

community, which leads to infractions. However, the level of compliance has increased since 1999 and continues to improve each year [16].

In the 2001 fishing season, an innovative management strategy was trailed during the lobster season. Rather than using TAQ, a minimum Catch Per Unit Effort (CPUE) level of 5.8 kg per diver per day was set as a trigger value, which if passed would force an emergency meeting of the PMB to halt the fishery. The 5.8 kg per diver per day value, based on CPUE records for the 1998 lobster season, was the lowest recorded since the start of adequate record keeping. During 2001, CPUE was reported every 2 weeks during the season but did not approach the trigger value.

This trigger value system is complex but has a clear benefit in that the season will not be peremptorily closed when catches and resource levels are both high, as occurred in 2000. Nevertheless, although the CPUE trigger value is now accepted by all stakeholders of the GMR and is requested for use in other fisheries, its usefulness will not be fully determined until response actions are triggered by low CPUE.

There is no doubt that improvements in the management and conservation of Galapagos marine resources have occurred through vastly improved communication between stakeholders and through increased participation of stakeholders in decision-making. In contrast to the earlier period of mutual distrust and disregard for sustainability, the different sectors involved in marine resource management and utilisation are now co-operating. Recent fisheries for spiny lobster and sea cucumber were conducted with the combined effort of management authorities and fishers who actively participated in design, planning, and negotiation of sustainable practices. For the rock lobster fishery, fishers were trained before the fishing season, participated in the design and planning of regulatory measures, and were actively involved in fisheries monitoring. Similar procedures are followed for other fisheries.

Tensions certainly still remain between different stakeholders at the negotiating table and full acceptance of the participatory process is slow, as indicated by violent protests of some local fishers in Isabela Island in May 2000 over the total quota of sea cucumbers agreed by co-operative representatives. Protests took place again in November 2000 over the quota of lobsters. The sea cucumber fishery, in particular, is a very high-value fishery that is easily accessed and has exerted disruptive effects throughout Galapagos society. This fishery greatly affects fishing co-operative's attitudes and internal power structures. Nevertheless, despite the tensions, the participatory process continues, fishers come to the table, co-operate on collecting the monitoring data, and discuss the results. Therefore, the process appears to be on the right track, but changing social processes takes time, especially given a lack of traditional social structures in local fishing communities with a high proportion of relatively recent economic migrants.

Thus, while the changes established during the past 5 years have been overwhelmingly positive, they remain on a relatively unstable foundation. A period of consolidation and strengthening is required. Now that the fishing registers have been properly closed at 869 fishers, the task of reducing fishing effort on sensitive coastal areas by retraining fishers into tourism and other industries, and moving part of the current fishing activity into offshore waters, needs to be afforded high priority. Amongst other tasks that need to be accomplished are passing regulations to close legislative loopholes exploited by local fishers, including how large a boat can be while remaining artisanal, and better establishing lines of communication with individual fishers rather than relying largely on communication through fisher representatives.

6. Tourism

In both Galapagos and San Andres, tourism is the main contributor to the economy [13]. In the Galapagos, there is an order of magnitude difference between the earnings generated by fisheries and tourism exports. Employment statistics indicate that tourism-related employment accounts for 30% of total employment while direct employment in the fishing industry is less than 10% of the workforce. Actual numbers involved in fishing including part time fishers will be significantly higher. The difference is more marked in San Andres where fisheries account for less than 1% of local GDP and tourism directly accounts for over 40% of local GDP. In terms of employment, it is estimated that the tourism sector employs in the region of 5000 people, while there are estimated to be about 400 fishers on the islands. However, as noted above there is a particular cultural significance to the artisanal fishery in the islands of San Andres. Artisanal fishers are native islanders (raizales), whereas the tourism sector primarily employs residents from the Colombian mainland. In OPSC, artisanal fishing is still of great importance to the local economy, with up to 25% of the population dependant at least in part on incomes from fishing.

Tourism in the Galapagos relies on an international market of visitors particularly from the US and Europe. Galapagos offers a very specialised product to a well-informed and well-travelled group of visitors. Tourism is dominated by cruise vessels that visit sites of environmental interest on a number of the islands. Visitors are typically professional or managerial classes or retired. Holiday expenditure is high, particularly amongst visitors from the US [13].

The international and highly specialised tourism of the Galapagos contrasts sharply with tourism in San Andres. San Andres caters almost exclusively to a domestic Colombian market. A large percentage of tourists come from relatively high income—by national standards—professional and managerial classes from mainly Colombian cities. San Andres competes with mainland Colombian resorts for this trade. San Andres is viewed as a family holiday destination for ‘sun and sand’ based holidays. The domestic nature of the market is not only different from the Galapagos but is also not typical of the wider Caribbean. The reasons for the structure of tourism in San Andres are partly historical, the development of commercial tourism after the granting of free-port status, and partly current. The security situation in mainland Colombia is both a deterrence to foreign visitors and an incentive for mainland Colombians to visit. Colombians also have limited access to international destinations. Visas are required for most sites and direct flights are limited. Few Caribbean destinations, for example, can be reached directly from Colombia.

It is notable that although both the Galapagos and San Andres are highly dependant on specific groups of visitors, this is particularly the case in San Andres. This dependence produces a high level of *specific risk*, i.e., risk specific to these particular trading partners rather than the tourism industry as a whole. The tourism industry in the Galapagos appears to be in a strong position. Numbers of foreign tourists have increased steadily over the past two decades and the Galapagos appeals to a high-end specialist market, which is widely recognised as a growth area. Indeed, most of the concerns surrounding the industry in the Galapagos centre on limiting the impact of tourist numbers rather than increasing demand. Holidays in the Galapagos are, however, regarded by many visitors as expensive, so demand for this product has increased in line with increasing incomes in Europe and the US during the past decade. An economic recession in Europe or the US, causing a fall in

incomes, would most likely lower demand for holidays. It is noteworthy that economic growth in Europe and the US, in particular, is slowing. The terrorist attacks of 11 September 2001 in the US and subsequent conflict in the Middle East are adding to economic uncertainty. In addition to economic issues, security concerns have already had a dramatic impact on international travel. Ultimately Galapagos cannot avoid being affected. Indeed, it is US citizens, many of whom are already reluctant international travellers, and upon whom the Galapagos is particularly dependant, that are most likely to stay at home. It is difficult to say how long these effects will last. The events of 11 September were not predictable and illustrate the risk of over-dependence on any particular body of visitors.

San Andres, reliant as it is on domestic tourism, is less likely to suffer from a decline in international tourism. However, because of regional inter-dependence, there will of course be knock-on impacts on the Colombian economy as a result of recession in the US, which will ultimately affect demand for holidays in the islands. Increasing the number of international tourists (in line with other Caribbean destinations) is one option that presents itself for the future development of tourism in San Andres. Existing international tourists appear to view San Andres as a budget holiday option. Breaking into the wider Caribbean tourism sector would put San Andres in direct competition with many well-established destinations. If higher-spending international tourists are to be attracted to the island, a key challenge is the improvement of the tourist infrastructure to a standard comparable with other destinations. However, the lack of political stability and poor security situation on mainland Colombia are likely to remain deterrents for foreign investors and international tourists alike.

6.1. San Andres

The manner of utilisation of coastal areas in the San Andres Archipelago, as “open access regimes”, has not allowed for real planning as regards both the magnitude of the activities being carried out and the space involved [17]. These activities are mainly water sports, tourist transportation and recreation on the beaches and cays. The consequences are reflected in the many conflicts arising between the users of common resources, especially the beaches on San Andres and the internal areas of the bay, or those areas designated for boat traffic. Sensitive areas warranting protection such as the shallow reefs within the lagoon, the mangroves and seagrasses are rarely taken into account when these activities are being carried out. This situation is not only endangering economic sustainability but is also impacting other productive sectors such as fishing enterprises.

In this sense, if clear short- and medium-term actions for management of coastal areas are not put into effect, tourism as well as other activities on the island will continue to be affected. Aspects that favour the deterioration of this sector are water pollution (the sea and groundwater) and land pollution, with their subsequent impacts on health and ecosystem components; accumulation and poor handling of domestic and toxic waste; high demands on natural resources accompanied by intensive use of water and electric energy; and uncontrolled urbanisation into woodland and highly productive farmland.

The archipelago must simultaneously and strategically bring about a change in the modality and style of the present tourism model, especially on San Andres Island. This change should be directed away from tourism based on high consumption of limited natural resources towards tourism that reduces consumption to sustainable limits. The

massive influx of tourists distributed unevenly over time, with low consumer capacity, should be reduced to levels below the load capacity of services and resources, and efforts should be redirected towards tourism willing to pay to conserve, maintain, and enjoy the landscape and to recognise the environmental costs that their activity produces. This is a task that requires a change of awareness and of attitude on the part of both tourists and the tourism industry.

As one of the objectives of its short-term action plan, CORALINA has proposed designing actions directed towards all of those persons, enterprises, or entities that wish to carry out productive, commercial, or service activities in the archipelago so that their location, use of resources, and handling of the environment will be compatible with the potential for use of natural resources, the fragility of ecosystems, and the mitigation of negative impacts caused by such activities [17]. In this regard, CORALINA has several projects directed towards producing new foundations for sustainable tourism. On the one hand, a programme has begun jointly with island hotel management in order to create dialogue and long-term activities directed towards achieving the changes in business management necessary for sustainable tourism. This project is called “Environmental Stars” and includes an academic curriculum that is included in the tourism training programme presently offered by the San Andres’ technological institute—INFOTEP. The MPA project, discussed further in Mow et al. (this special issue), will produce guidelines for the use and exploitation of marine resources. In addition, actions for tourists and residents will continue to be developed that aim to initiate changes in favour of sustainable tourism: water-saving campaigns and campaigns regarding handling of waste, type of consumerism, maintenance and preservation of beaches and preservation of the environment in general (flora, fauna, soil, coastal and marine ecosystems).

6.2. *Galapagos*

Tourism in the Galapagos has developed under a management plan that allows limited numbers of tourists at selected sites in the National Park. Since the advent of tourism in the mid-1960s, the number of tourists has increased from 4500 in 1970 to over 65,000 in 1999. With tourism comes development, and the current view is that development is causing an increase in the detrimental effects to the environment. The main ecological impacts associated with tourist activities and facilities were to be physical alterations of habitat, interference with fauna and flora, waste discharge and littering, exploitation of resources, introduction of species, site-specific impacts and other tourist-related impacts such as diving activities [18]. Revenue generated by the tourist fees that visitors pay when entering Galapagos National Park is a positive impact of tourism.

The main conclusion of an environmental impact assessment, undertaken as part of this project [18], is that the principal environmental damage related to tourism occurs not from the direct impact of people on visitor sites, but from the indirect effects of the support structures and population needed to support the industry. With the increasing number of tourists and related population, there is a corresponding increase in the facilities and services needed for these visitors. As the population grows, so does the demand for scarce resources. Residents need water, imported food, building materials and many other items. The threat posed by the growing number of residents and tourists stems equally from the increased mobility of people and goods between Galapagos and the mainland and between islands. This increased mobility (in aeroplanes, freight lines, fishing boats and tourist

boats) is jeopardising the most important condition that has allowed for the unique evolutionary processes on the islands: their isolation. As the circulation of both people and goods increases, there is a mounting danger of the introduction and dispersion of exotic species that disturb the dynamics of the evolutionary processes and the extraction of resources for export markets, as well as the increased potential of pollution. Furthermore, the impacts on the marine environment from the physical alteration of habitats, such as clearing mangrove and lagoon areas for building, are an issue of concern. All of these impacts can lead to reduced biodiversity and species loss.

Conflict exists between the fishing and tourist sectors in Galapagos. In part, conflict has arisen owing to the fishing activities of the tour boats. Although tour operators are prohibited to fish during tourist voyages, it is locally recognised that crews of some tour boats fish to meet food needs. This has resulted in competition between the fishing and tourism industries as both attempt to extract the same resource. The adoption of zoning in the marine reserve may influence this conflict and is discussed further in Heylings et al. (this special issue). It is notable that during considerable debate on the zoning scheme, by far the majority of conflict was between the conservation and fishing sectors. While the fishers would consider tourist zones, the idea of non-extraction zones was not acceptable initially [18]. Only after pressure from government associates and an imminent deadline was a decision on this issue agreed.

7. Discussion

Although CORALINA is the environmental management and regulatory agency for the San Andres Archipelago, it is obliged to interact with various other institutions with legal authority covering particular aspects of coastal and marine management (e.g. DIMAR, INPA, the Departmental Government, the Secretary of Fisheries and the Departmental Fishing Board). Little coordination occurs between national, regional, and local entities in programme development, fisheries management, and enforcement protocols. In some cases, inter-institutional councils have been set to better co-ordinate activities (e.g. CORALINA's board of directors, the Departmental Fishing Board, and the Departmental Environmental Education Committee). However, these councils need to be more effective in representing their constituencies or organisations and in fostering inter-agency co-operation.

One additional problem in the San Andres Archipelago is the dissemination of information, which is complicated by the difference between the English language, which is native to the islands, and Spanish, which was the only legal language in Colombia until the 1991 Constitution. Spanish is used almost exclusively for legal documents, education, political processes, nationally based scientific research, and by the media. It is also the spoken language of the mainland immigrants who have settled in the islands in the last 25 years. While the Constitution recognises English as a legal language in the islands, this acknowledgement followed a period of officially sanctioned language discrimination. Even today, regulations are written and posted only in Spanish. Since its inception, CORALINA has worked extensively with local resource-user groups, empowering them with information on environmental regulations, policies, and rights translated into their native English. Numerous meetings and educational events are also held throughout the island to disseminate environmental information and increase awareness. Community groups, teachers, schools, businesses, and public institutions are targeted. There is also an

increasing amount of information broadcast in both Spanish and English on television, in local publications, and on the radio, which is the most popular communication media.

The management challenges in the San Andres Archipelago are many. The type of co-ordinated management needed for the coastal and marine areas is defined as Integrated Coastal Management (ICM). Because planning and management need to be based on linkages between terrestrial, coastal, and marine ecosystems, on small islands the entire island and surrounding sea can be considered part of the coastal zone. In general, the issues that need to be addressed by ICM in the San Andres Archipelago can be broken down into the following categories:

- *Ineffective management*: Problems resulting from the open access regime, lack of integrated environmental management, inadequate co-ordination between coastal and marine authorities, and failure to enforce regulations.
- *Unsustainable and inequitable use*: Resource depletion and habitat damage from overfishing and bad fishing practices, increasing uncontrolled subsistence exploitation from poverty, and a lack of local benefits from national policies of resource exploitation.
- *Pollution*: Environmental degradation from inadequate management of solid, liquid, and oily wastes; poor land use practices and deforestation causing siltation; and other pollution sources.

Consistent with its “bottom-up” approach to environmental management, to address these challenges CORALINA has engaged local stakeholders in a participatory identification and definition of issues, conflicts, and threats. Major social issues raised by stakeholders are:

- *Marginalisation of the native community*: The failure to recognise and respect rights to traditional tenure to the archipelago’s coastal and marine areas, concern that management alternatives will be politically manipulated to further reduce local control rather than resulting in native empowerment, lack of opportunities for natives to work in and benefit from tourism, and the importance of integrating traditional knowledge about fisheries, habitats, and use into scientific assessments and management planning.
- *Cultural diversity*: Tensions between islanders and continental immigrants, language differences, introduction of values that lead to social stratification along with inequity, and lack of respect for and loss of native cultural values including the failure to inform tourists about native customs and acceptable behaviour.
- *Strained relations between archipelago inhabitants and the national government*: Insufficient local autonomy in marine resource and fisheries management due to political and institutional centralisation, lack of response to the particular environmental needs and limitations of small oceanic islands, the national economic crisis, long-standing policies of paternalism and colonialism towards native islanders, imposed isolation from the rest of the Caribbean, inadequate and inequitable control and enforcement, and the aforementioned conflicts over fishing rights.

Based on the information gathered, CORALINA and the community, together, chose their preferred marine management alternative—the establishment of multiple-use MPAs (Davos et al., this special issue; Mow et al., this special issue). Participation in the project

and application of the AGORA support system (Davos et al., this special edition) facilitated the generation of results from this participatory process to support design of MPA zoning including:

- Translation of issues into criteria for evaluating specific management intervention.
- Estimation of the priorities that local stakeholders give these criteria.
- Estimation of area distributions of different MPA zone types preferred by local stakeholder groups.
- Assessment of conflicts among stakeholder priorities and the potential for their management.

Currently in the Galapagos Islands, the main efforts are also directed toward strengthening the recently established participatory management process. This involves issues such as increasing the willingness of the stakeholders to co-operate, improving the representation of each stakeholder at the discussion and decision-making forums, and in general the implementation of the management plan for the marine reserve.

Despite the commitment of the Ecuadorian Government to protect the Galapagos marine environment, local fisheries prior to 1996 were marked by lawlessness on the seas, scant regard for legal regulations or principles of environmental sustainability, and overt hostility of fishers to personnel involved in fishery management and science—culminating in physical threats and the destructive occupation of CDRS and GNPS premises in 1995 during the so-called “pepinero wars”. The numerous government decrees that were made, including the management plan for the GMRR, were widely ignored. For example, in 1994 a total catch quota for sea cucumber (pepinos) was set at 550,000 animals, whereas between 6,000,000 and 12,000,000 were estimated to be captured that year. Problems in controlling fishing activities, plus associated illegal activities such as the establishment of fishing camps in wilderness areas and the killing of land tortoises for food, escalated once fortunes were seen to be made by illegally exploiting sea cucumbers. This period was also marked by rapidly accelerating immigration from the Ecuadorian mainland in response to the rich economic opportunities provided by the sea cucumber fishery.

The recent improvements in management and conservation of Galapagos marine resources have occurred through vastly better communication between stakeholders, through increased participation of stakeholders in decision-making, and through improved government legislation and regulations that explicitly recognise conservation of Galapagos biodiversity as an overarching principle. An example of this improvement is seen with the process to zone coastal waters.

The GMR management plan, approved in March 1999, defined categories of zones, including two kinds of no-take zone (one with tourism permitted, the other just for science and conservation management). However, it was not possible at the time to agree where the zones would be, so the management plan set out a 4-year process for establishing the zoning. The reasons for the 4-year process were both to gain experience of the initial effects of no-take areas and to give the fishers time to appreciate that no-take areas bring benefits as well as restrictions. The leaders of the four fishing co-operatives at that time said that, whilst they personally appreciated the rationale for no-take areas, they could not deliver the support of their members, who were almost all opposed to the idea. In March 2000, after long negotiations and skilled facilitation, the provisional zoning scheme was agreed

by consensus between the GNPS, fishers, scientists and tour operators (see also Heylings et al., this special issue).

Other issues of importance that need to be addressed include:

- *Pollution in the GMR from development and increase in the human population, including contamination produced by human waste materials and sewage.* These effects are localised around the main ports. In the past, with fewer inhabitants, waste products were dispersed sufficiently far from the populated areas. However, programmes are increasingly being developed to deal with these problems, and contamination is being minimised. Previously, tourist and fishing boats discharged waste directly into the sea, but this practise is also being reduced.
- *Visitors/tourism pressures.* Apart from localised pollution, tourism has few obvious effects on the marine ecosystem, in part because the main marine visitor sites consist of rocky reefs rather than coral reefs. Studies have shown that ‘snorkelling’ and diving produce few direct effects [18]. However, fishing from tourist boats has caused tensions with local fishers and may affect sensitive zones. Fishing from tourist boats is now prohibited. The greatest impact of tourism is clearly indirect, in that development and population growth in Galapagos as a consequence of increasing tourism activity causes gradual declines in environmental values.
- *Special Regulations of the Special Law.* Drafting of Special Regulations to legally define artisanal fisheries and tourism activities has been delayed, adversely affecting management of these activities within the reserve. Consensus among the stakeholders on the drafting of the regulations has been difficult to achieve for two main reasons: the regulations should provide both legal and policy guidelines and a clear framework for effective stakeholder negotiation within the PMB and not vice versa, and insufficient time is available for a consensus-based approach, especially considering the fact that the fisheries sector does not share a coherent vision. The situation is complicated further by the threat to the negotiations posed by influential members of the fishing sector who would be affected by the closed access policy. Therefore, the PMB is unlikely to derive a consensus proposal for the regulations, but needs to ensure that the drafting process is transparent and that the stakeholders feel that they have been consulted and taken into consideration. Through the PMB, the stakeholders will be able to make detailed comments on the different drafts of the documents and will analyse the level of agreement possible between the different actors on certain decisions.

There are some similarities between the San Andres Archipelago and the Galapagos Islands related to internal stakeholder conflicts, conflicts with authorities, the importance of tourism to the local economies and the problems associated with this sector’s expansion. What is apparent from an examination of both island groups, however, is the degree to which local stakeholders have been involved in guiding plans on future management of their respective islands’ resources. Local islanders in the San Andres Archipelago have placed themselves squarely behind plans for Biosphere Reserve designation and are willing to participate proactively in its planning and regulation, including the establishment of a system of use zones and MPAs. This has largely been achieved since 1998. A longer standing participatory process existing in Galapagos has similarly contributed to the development of the marine reserve management plan and the Special Law. A system of provisional zoning is already in place and is currently being evaluated.

Stakeholder participation has been essential to progress in marine resource management within both island groups. However, challenges remain, including the ways and means to effectively measure the performance of MPAs including the success of zoning initiatives.

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